

Mount Diablo Astronomical Society

Diablo Moon Watch

December 2011

GENERAL MEETING

Tuesday December 20, 2011

MDAS at the Movies

By Chris Ford

*Doors open at 6:45 p.m.
Concord Police Association Facility
5060 Avila Road, Concord*



December is MDAS at the Movies month chosen by popular vote on the evening. This years selection is one of:

IMAX documentaries:

- Space Station (47 minutes)
- Roving Mars (40 minutes)

Classic 1950's movies:

- Forbidden Planet (89 minutes)
- When Worlds Collide (82 minutes)

Archival NASA footage:

- Exploding rockets (Part 2)
- In the Shadow of the Moon (100 minutes)

Come and vote in the end-of-year elections, the annual State of the Society review.

Here is the slate of candidates for the Board of Directors (all currently unopposed, all incumbents):

President: Chris Ford

Vice President: Rick Linden

Secretary: Moon Trask

Treasurer: Wil Roberge

Membership Coordinator, Mtg Room:

Marni Berendsen

Meeting Program Chair: Dick Flasck

Outreach Coordinator, AANC Rep:

Jim Head

Publicity Board Member: Steve Jacobs

Observing Committee Chair, Board

Member: Richard Ozer

Whats Up Coordinator, Board

Member: Kent Richardson

Newsletter Editor: Vianney

Webmaster: Glenn Spiegelman

New Member Steward: Nick Tsakoyias

Stellar Alchemy

by Steve Jacobs

Nucleosynthesis:

Nucleosynthesis ("NS") - fancy word for making heavier atoms from lighter (i.e. alchemy) Stellar Nucleosynthesis is the process in which stars churn out different atoms. The word is made up from Nucleo - as in nucleus and synthesis as in producing. The atom - for those of you who might need a reminder:

Left image shows 4 atoms H (hydrogen), He (helium), Li (lithium), and Na (sodium)

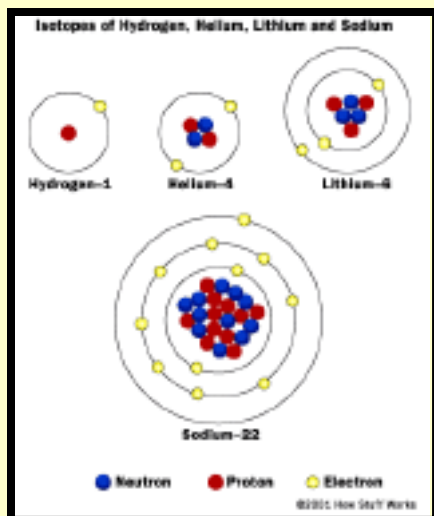
Note that the center has a nucleus of neutrons (neutral particles shown in blue) and protons

(positive particles shown in red) surrounded by electrons (negative charge shown in yellow).

The number of protons (and electrons) determines the atom and the number of neutrons determines the isotope of the atom. In the example above H1 has 1 proton and no neutrons (and 1 electron); and He4 has 2 protons, 2 neutrons (and two electrons).

If we had H2 or H3 -deuterium or tritium, we have just increased the number of neutrons to make different isotopes of hydrogen.

(Continued on page 8)



PRESIDENT'S CORNER

The Launch of Curiosity

by Chris Ford

This Thanksgiving holiday I was very fortunate to receive an invitation to attend the liftoff of the Mars Science Laboratory rover "Curiosity" from Cape Canaveral.

Never having witnessed a live rocket launch before, the invitation presented a rare opportunity to be present at the commencement of a major science mission and to also visit parts of the cape that are rarely accessible to the public. It was with little hesitation that on Friday November 25th 2011, my two sons and I flew to Florida and joined our party for a two day tour of the facilities associated with the Curiosity mission followed by the launch itself on Saturday 26th.

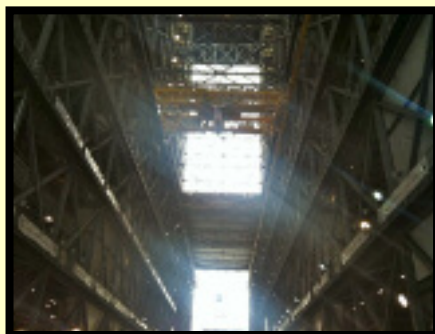
Our day started early on Friday November 25th with a visit to building AE for the launch team briefing. This building is where "classic layout" mission control rooms are located to monitor and control the launch. As we were on a tight travel schedule, I had been regularly checking on the status of the launch vehicle online throughout the week, as any delay would mean us missing the liftoff if it was postponed a day or more. While sitting in the launch operations briefing room, I unconsciously took out my iPhone to check for updates on the launch, and suddenly realized the absurdity

of sitting at a desk with the actual vehicle and mission data in front of my eyes at the very place from which it will be launched!



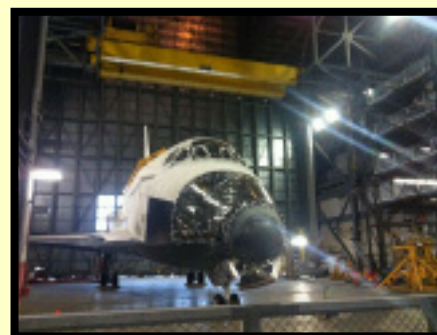
Launch Operations Briefing

Before visiting Curiosity at the actual launch pad, we stopped off to visit the historic Vehicle Assembly Building where the Saturn V and Space Shuttles were prepared for launch before rollout to the pad. This is one of those places where pictures cannot convey the stupendous size of the place, one of the largest enclosed volumes in the world. The Space Shuttle Endeavour was in residence in one of the side bays, a sight I found somewhat bitter-sweet seeing this supreme example of technical achievement, now in a state of deactivation and destined for a museum. In general the



Looking up in the vast central aisle of the VAB

huge building felt somewhat "empty" as it marks time before the proposed Space Launch System (SLS) is prepared for its first flight in 2017. The historic resonance of the building, covered in banners wishing success to various past missions, was overpowering however.



Space Shuttle Endeavour in a VAB side bay being deactivated for the museum

Next to the launch itself, the highlight of the visit was undoubtedly a visit to Space Launch Complex 41 to get up close and personal with the Atlas V launch vehicle with the Mars Rover Curiosity already encapsulated under its payload shroud and ready for launch. A few hours before our visit, the booster had been rolled out of the nearby Vertical Integration Building (VIB) on a mobile platform in a similar manner to the Space Shuttle pad rollout procedure. After passing through several security barriers we managed to approach within a few hundred feet of the Atlas, that though not yet fueled with kerosene, liquid oxygen and liquid hydrogen, definitely was surrounded with live solid propellant motors and armed with various pyrotechnic and self destruct devices! It was actually fairly quiet

The Launch of Curiosity *(Continued from the previous page)*

around the base of the launch vehicle itself, as all the essential work is performed indoors in the VIB, after which vehicle operations are automated in the final 24 hours after rollout to the launch pad. Launch was scheduled for Saturday morning with the 1.5 hour window to Mars opening up at 10.02 am. As it turned out, Curiosity is a very punctual Mars rover.



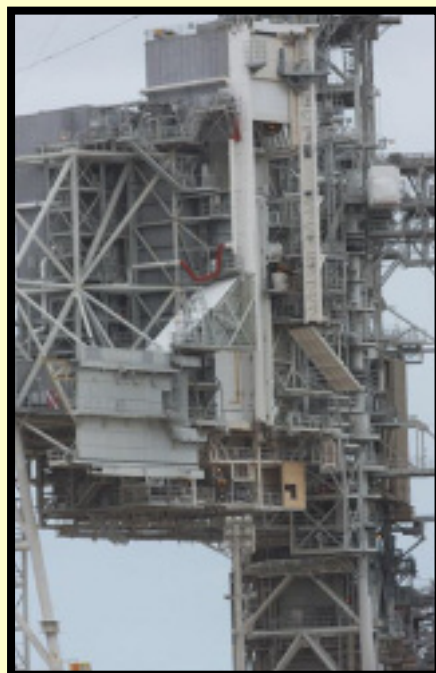
The Atlas V ready for launch. Note the high speed cameras in the foreground



Close enough? The payload shroud encapsulating Curiosity

After leaving the Launch Complex 41, we returned via the coastal road that leads right past the historic launch pad 39A from which Apollo 11 departed for the Moon. Like the VAB, when you are close to the actual launchpad itself, pictures do not convey how vast it truly is. Sadly there were already signs of rust and decay on the service structure (which will soon be demolished) and tufts of grass in the concrete here and there. We drove back along the crawler way along the road that the astro-

nauts travelled to the pad, ending what was a remarkable first day visit.



The now obsolete service structure on launch pad 39A that will be demolished soon

On Saturday we were picked up early by NASA bus and taken to the viewing location for the launch on the 5th floor of the NASA Administrators building (OSB II) next door to the VAB. The view from the balcony was amazing, the famous Saturn and Shuttle launch complex's 39A and 39B were only just over 3 miles away and launch complex 41 where the Atlas V stood ready for launch about 4 miles away. Before our eyes extended the whole panorama of the Kennedy Space Center with the famous countdown clock right in front of us.

We were served an astronaut worthy NASA breakfast, then attended a comprehensive briefing from the NASA Administrator Charles Bolden himself and the

principal mission scientists. It was a pretty select and eclectic group including families with special guests, 5 years olds and teenagers, foreign dignitaries, engineers, politicians, ex and current astronauts, all coming together in one room just for this occasion. This was the VIP launch viewing party and I was pretty fortunate to be there.



NASA Administrator Charles Bolden briefing us on the morning of the launch

After the briefing, everyone walked out to the 5th floor balcony to view the launch itself at 10.02 am as the countdown continued to proceed without a hitch. We had been forewarned that the view of the liftoff from 4 miles away would not be as good as television, but that the experience, especially the sound, would be spectacular. We were also advised by launch veterans that the experience would be as much about the excitement shared with everyone else, especially the odd time-dilation effect as the apparent passage of time changes speeds several times, moving slowly for the first hours, then speeding up until the terminal count, followed by 4 incredibly slow minutes leading up to ignition, then the fastest 90 seconds that we would ever experience.

The Launch of Curiosity (Continued from the previous page)



The most amazing location from which to see a major launch.

Well that is exactly what the experience was like... with the exception that it was a lot better than television! As liftoff approached, the atmosphere suddenly became electric as everyone on the balcony counted down the last 10 seconds aloud and cheered and waved as the rocket rose off the launchpad, literally willing it heavenwards. The brightness and deep orange color of the Atlas V's exhaust flame cannot be captured in pictures and for the first 8 seconds or so it rose in complete silence as the sound travelled the 3-4 miles towards us. Then the sound suddenly hit as a deep penetrating roar that grew louder and louder then slowly faded in intensity as the Atlas V arched over into the sky on its way to Mars. After we lost sight of the Atlas among the higher clouds, we moved back indoors to the auditorium where on-board cameras mounted on the launch vehicle followed it through the 11 minutes of powered ascent. After short refreshments, it was a little unreal to consider that the rocket that we had just been looking at 4 miles away was now passing over Africa. After further refreshments, Curiosity was approaching Australia where

the Centaur upper stage ignited again to power Curiosity into an escape trajectory towards Mars - it was fast!



Liftoff!



On our way to Mars! The sound started arriving about now

The launch was precisely on time at 10.02 am and perfect in every way. We now have an 8.5 month wait until Curiosity arrives at Mars for the Entry, Descent, and Landing (EDL) phase in what appears one of the most hair rais-

ing planetary landing techniques ever. All being well this is when the real excitement starts. The only downside was that we could not go with it!

Having now experienced a major space mission launch live and from as close as it is possible to be, I am impressed that pictures and video do not capture the sheer drama and majesty of the event. If you ever have the opportunity to see a major launch, seize it.

***Happy holidays to all
MDAS members!***

Chris Ford

A Message from Andromeda

by Nathaniel Bates

Greetings. Or, maybe hello. I am not quite sure how best to address your planet.

I do not want to sound like the stereotypical “alien” from your television or movie. In actuality, we do not speak amongst ourselves like the caricatured aliens of some kind of science fiction narrative. In our language, we speak simply. Our sentences are not long. They tend to be terse, with clicks and whistles. Our language evolved to be to the point. However, we do possess strong musical and poetic skills that allow us to communicate in complex sentences when we are conveying deep feelings. It is with deep feelings that I send you this message, if indeed you are capable of receiving it.

Understand that we do not know if you are going to be able to receive this message because of the distances involved.

We are 2.55 million light years from you. Here is where things get complicated. We are 2.55 million years in to the future from December of 2011. We decided to respond to a series of radio broadcasts from you with a light beam pulse of our own beamed back to you. We have been studying your

language for a long time, but we have finally decided to respond. It will take 2.55 million years for the message to come to you. Now, what is interesting is the whole concept of time involved here. Your Albert Einstein called time a “persistent illusion.” The whole concept of “now” became relative



when Relativity became known to your planet. For a light beam, time as you and I understand it never passes, since the speed of light bends space and time to such an extent that no time passes at that speed. The light beam never experiences the passage of time as it travels through space.

From the standpoint of light, the 2.55 million years is experienced as a single instant.

The “now” moment is defined by the passage of light so in a way we are experiencing the same “now” that you are. Indeed, even slight variations in motion can define the passage of time in dif-

ferent ways. Once we return this message, you will be 2.55 million years in the future but the transfer of information will be complete such that whoever receives this on your planet will experience December 2011 as a relevant time. No bones about it—this will happen 5.1 million years

from your time because the speed of light is constant. But, the light beam itself will experience no passage of time and in some sense will bear solid witness to your time and place to your descendants in the far future. How ironic, in that you will be reminded of your past by a light beam that never experienced any time from its own standpoint.

Whether you still exist, or whether you are extinct by then, is not known to us. Really, it is up to you. By then you will have made your decisions, gone in the directions of your choice. As it is, your species has polluted its environment. It has gotten enmeshed in wars. It has called dictatorships “people’s democracies” and wars of destruction “spreading freedom.” Most of your political discourse is at the lowest intellectual level as evidenced by your recent Presidential debates. The power of wealth and influence has overcome what little democracy you have left. Finally, you are still dependent on fossil fuels that are literally killing your planet. You are even denying that you are killing your own planet.

A Message from Andromeda *(Continued from the previous page)*

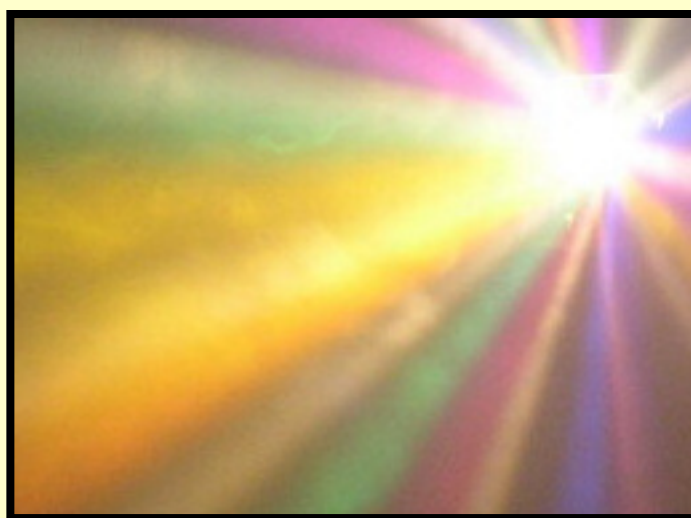
You say you are the most advanced species on your planet but understand that the bacteria never destroyed their environment. At least they did not do so consciously, continuing to destroy while possessing the ability to stop themselves. The human species may or may not be the most intelligent. Your dolphins are pretty high up there. But, we concede that you are great tool makers. You are better than we are at tool making. We did not have what it took to be space faring due to our lesser tool making abilities, as well as our inability

to communicate in complex sentences unless we are conveying deep emotions, while it appears that you do possess these abilities that have helped you to become space fearing (again, you are receiving this light beam 2.55 million years in the future so we speak of ourselves in the past tense). We admire your courage in exploring your Solar System. Did you make it to the stars? We hope so, as much for the sake of your poor burdened planet as anything else. Indeed, we admire your species' tenacity in exploring space, your individuality, and your creativity. It is for this reason that we have merited you worthy of a response. Please hear us with the emotion that allows us to commu-

nicate in complex sentences.

As of December 2011, a number of your major religions celebrated the winter season as a time of light in the midst of darkness.

The winter season denoted a time of renewal and hope for humans of that time, and we can



only hope it still does so let us speak about it in the present tense. Indeed, many of you see this season as a time of compassion. While your culture's expression of these holidays has often degenerated in to materialism and consumerism, we respect the ideals of compassion that marks "the holiday spirit." There is something that humans need to know. Light is the cosmic speed limit. The light cone that Einstein discovered defines time. There is no getting around that fact, no way that you are going to escape it. However, love is the one force that our own philosophies consider might be able to transcend that limit. If there is a "now" defined by love, it is one that can take

under its wings all living creatures, everywhere in the Universe. This "now" is seen by our philosophers are transcending time and space, of including every moment within itself. We do not expect you to understand this, because our spiritual philosophies are somewhat different than yours. What we would instead share is a quote from your own Albert Einstein that roughly encapsulates our beliefs:

"A human being is a part of a whole, called by us 'universe', a part limited in time and space. He experiences himself, his thoughts and feelings as something separated from the rest... a kind of optical delusion of his consciousness. This delusion is a kind of prison for us, restricting us to our personal desires and to affection for a few persons nearest to us. Our task must be to free ourselves from this prison by widening our circle of compassion to embrace all living creatures and the whole of nature in its beauty."

We are disappointed that you have not widened your circle of compassion, but we are disappointed because we know that you are capable of it. In that respect, our species are very similar and in this way we have hope but, our friends, you must decide!

We are in your future. Whether you have broadened your circle of compassion depends on a lot of factors. Did you practice the virtues your species preaches about doing the right thing? Did you reach out beyond yourselves to embrace other humans, other animals? Did

A Message from Andromeda *(Continued from the previous page)*

you decide to stand with those who decided to stand for the highest virtues of your society? We wish we knew the answers to these questions, but they are not up to us. The stars and galaxies will not solve your problems. You will. At least we hope you do. Your species is a great light. You have done much to advance science, the arts and philosophy. Whether that light survives depends on you. One thing is for sure. Your species rises and falls together. That is the hidden meaning of real democracy, and why it is that you desperately do need to "occupy" your country once again.

We are glad for those of you who appreciate your planet, and the vast Universe in which you live. We are glad for this because a mature species can feel its small place in the Universe without feeling that it is a diminished place. As you look up at the winter sky, the Andromeda Galaxy not being as prominent as during your summer months but still being somewhere in your memory, you will not see us because we do not yet exist. That is the limitation of time, defined by the speed of light. That we cannot change. What can be changed is your own perspective on your own planet, and one another. Of course, not

existing yet we have no influence on you because your time is already passed. Somehow, some way, we believe that you may have made the right choices by now. It is that hope that motivates us to speak to you now. We hope that by millions of years in the future we will be heard by some-



one. Since we can only convey holiday greetings in our own religions and from the standpoints of our own cultures, we pray that the Cosmic Now defined by love embraces all of you. We now end this transmission and hope it is received by your descendents.

Stellar Alchemy (Continued from page 1)

Not all isotopes of atoms are stable; some will radioactively decay into other atoms plus other particles usually alpha particles (ionized He atom i.e. no electrons) and free neutrons.

We will ignore electrons for the remainder of this article, because at the temperatures of star cores the atoms are ionized (stripped of electrons). Where did the electrons go – they are there just not attached to the atoms.

Elements:

The periodic table above is a listing of all of the atoms. There are 90 or 91 naturally occurring elements (and about 23 manmade elements).

This is all the elements there are – everything is made of these atoms in some combination. Elements are ordered from left to right and top to bottom by their atomic number (the number of protons in their nucleus). Elements on the left are metals, elements on the right are non-metals and on the far right column are noble elements (which are non-reactive).

Types of Nucleosynthesis:

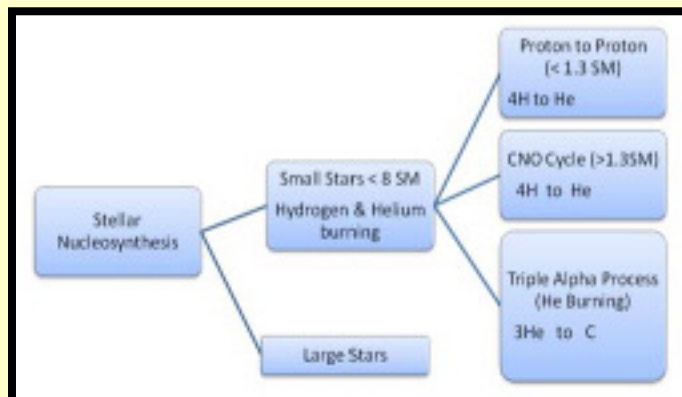
- Big bang – created hydrogen (75% by mass), helium (25%) and trace of lithium and beryllium (the next two lightest atoms). During the first 3-20 minutes.

- Stars created most of the rest – through Stellar or Explosive NS.

- Cosmic Ray Spallation – where high energy ions occasionally impact larger atoms and break them up into smaller atoms (source of most of the Li, Be and B)

- Real man made alchemy made the 23 synthetic elements (in particle laboratories).

Stellar Nucleosynthesis :



Divided into small stars (<8 solar masses (“SM”)) and large stars. SM is the mass of our sun and is a handy unit of measure (cosmic ounce).

Small Star Nucleosynthesis:

Small stars “burn” hydrogen to helium, helium to carbon and oxygen.

Burning – is the fusing of nuclei which creates new elements (as the number of protons changes) and in process releases huge amounts of energy (the resultant atom is lighter than the atoms we start with and using Einstein’s famous equation $E=MC^2$ we get energy). This is a similar process to that which occurs in an H-Bomb. Fusing is done in the core of stars at tremendous pressure and temperatures (excess of 4×10^6 K, 4 million deg).

There are two primary routes for stars to burn hydrogen – proton to proton or P2P (which accounts for the majority of our Sun’s energy) applicable for stars less than 1.3 Solar Mass (the mass of our sun SM).

Stellar Alchemy *(Continued from the previous page)*

$P+P=H_2+e+$ $H_2+P=He^3$
 $He^3+He^3=He^4+2H$ or He to Be
 to Li to 2 He $e+$ is positron.

The second route for stars greater than 1.3SM is Carbon Nitrogen Oxygen cycle. CNO cycle is where Hydrogen nuclei are bonded to Carbon creating various isotopes of Carbon, Nitrogen and Oxygen. This results in Carbon with helium as an end product. There are several steps in this process; with each step producing energy. CNO remains a catalyst in the process and is generally not used up. However some of C, N, & O are dispersed because of stellar convection.

The next step is when a star starts to burn helium - 3 He to C. This process is known as the triple alpha process (He ion aka alpha particle) $He + He = Be + He = C$. Some oxygen is also produced $C + He = O$.

At the end of the life of the star it may blow off stellar material and end up with a planetary nebula and white dwarf (such as M57, the Ring Nebula). Thus seeding the universe with heavier elements (up to C).

Big Star Nucleosynthesis:

Big stars (> 8 SM) continue and burn carbon creating heavier atoms until iron.

As in smaller stars; big stars proceed through the CNO cycle and Triple Alpha cycle. Then the star begins burning heavier elements by adding one or more He nucleolus. This occurs at higher temperatures and pressures than can occur in small stars (5×10^8 K, 500 mil deg). Carbon, Neon, Oxygen and Silicon burning:

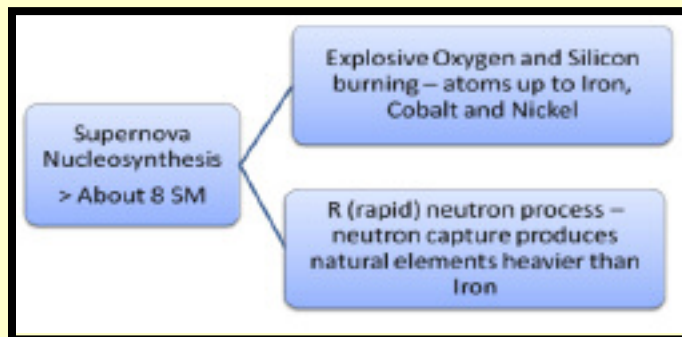
- Carbon to Neon, Sodium, Magnesium, and Oxygen
- Neon to Oxygen and Magnesium
- Oxygen to Silicon, Phosphorous, and Sulfur
- Silicon to Sulfur, Argon, Calcium, Titanium, Chromium, and Iron

Simultaneously the S (slow) Process makes heavier elements

from free neutrons. This process is very slow and produces small quantities of elements up to Lead. In the slow process neutrons are added to atoms nucleus resulting in an unstable

isotope which decays into a different atom; producing heavier atoms up to Lead.

Fusing (burning) elements past iron uses energy and if all the other lighter elements have been used up then the star collapses due to lack of sufficient energy production to keep gravity at bay.



This sudden collapse is a supernova

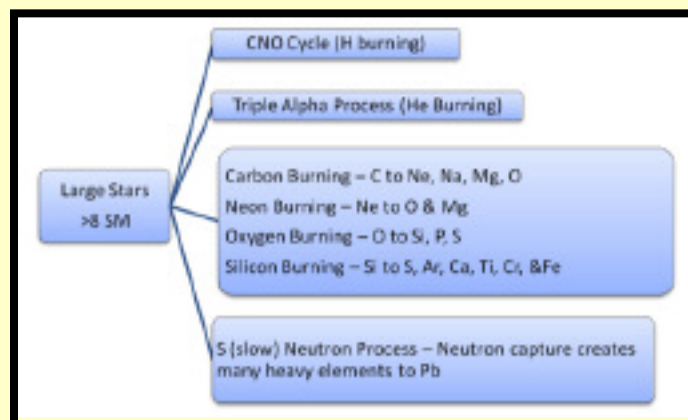
Explosive Nucleosynthesis:

The core collapse creates atoms heavier than iron (such as lead, silver, gold up to uranium).

Explosive Oxygen & Silicon burning - produces atoms up to Iron, Cobalt and Nickel.

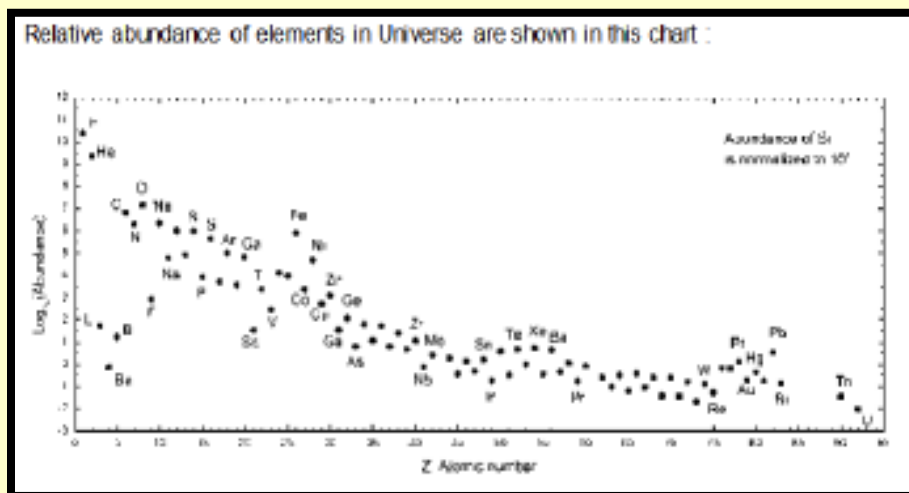
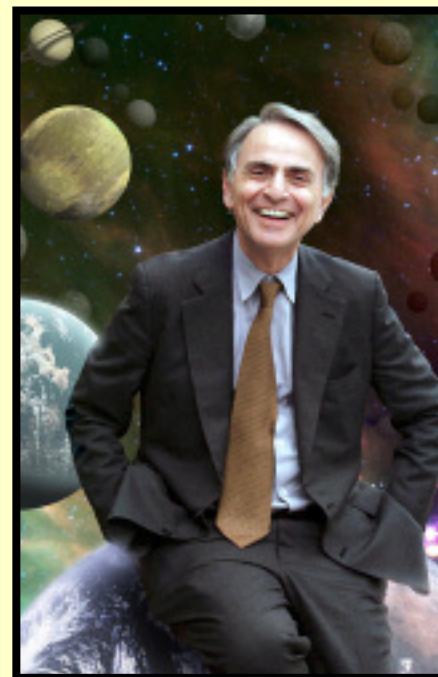
The R (rapid) process, which takes place in matter of seconds, occurs because the high concentration of neutrons in the core creates many heavy unstable isotopes which quickly decay into stable atoms.

There are other processes which have been proposed (Rp - rapid proton process) but are not as accepted.



Stellar Alchemy (Continued from the previous page)

The explosion not only creates heavier elements in a matter of seconds but also disperses both lighter and heavier elements into

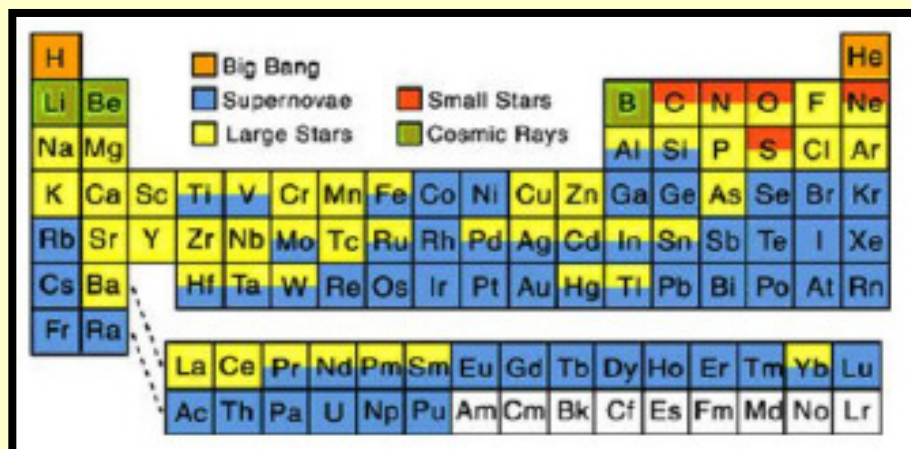


the universe. The results of the super nova is either a neutron star or a black hole such as Crab Nebula.

Abundance of Elements:

Relative abundance of elements in Universe are shown in this chart :

The Atomic number (elements) are along the x (horizontal axis) and the abundance is located on the y (vertical axis; note that it is logarithmic (i.e. 3 is ten times as much as 2)). There is a general trend of fewer heavier elements than lighter elements. Also note that even atomic number elements are more abundant than odd (because many elements are built from He (atomic #2)). Lithium Beryllium, and Boron are relatively rare (since they are really the result of gamma ray spallation of heavier elements).



Take a new look at the Periodic Table:

Colors point to the origin of the elements:

- Orange - Big Bang
- Red & Yellow Stellar NS
 - Red- small stars,
 - Yellow - large stars
- Blue - Explosive NS
- White - man made

Conclusion:

Carl Sagan, Cornell professor of astronomy and champion of popular TV Science, was fond of saying "We are all made of Star Stuff." What he meant was most of the material, atoms heavier than H & He, in our daily existence is distributed from supernovae or from the formation of a white dwarf

Mount Diablo Astronomical Society Event Calendar–December 2011

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|------------------|---------------------------|-------------------------------------|-----------|----------|-----------------------------|--|
| 27 | 28 | 29 | 30 | 1 | Project Astro JNH (Private) | 2 Observatory Maintenance (Private) 3 Sunset: 4:50 PM |
| 4 | Board Meeting (Private) 5 | 6 | 7 | 8 | 9 | 10 Sunset: 4:50 PM |
| 11 | 12 | MDAS Imaging SIG (Private) 13 | 14 | 15 | 16 | 17 Society Observing (Private) 17 Sunset: 4:51 PM |
| 18 | 19 | 7:15 PM GenMtg: Election & Movie 20 | 21 | 22 | 23 | 24 Society Observing (Private) 24 Sunset: 4:54 PM |
| Christmas Day 25 | 26 | 27 | 28 | 29 | 30 | 31 Sunset: 4:58 PM |

FOR SALE: MEADE LX200 (8") ASTROPHOTOGRAPHY SETUP.

I have just purchased a new imaging telescope and mount, and will be selling my current Telescope, mount, and some accessories. Includes:

- Meade LX 200 – 8" F10 Telescope and mount;
- Meade 1207 Electric Focuser;
- Meade balancing weight set;
- JMI hard carrying case for the LX200;
- Heavy-duty Milburn Wedge;
- LX90 OTA and Guide Star Mount; Meade
- Dew shield for the LX200; LX90 Dew Shield.
- Mount has blinking red-lights on the legs
- 25mm Meade Series 4000 Super Plossel eyepiece and 90-degree Diagonal eyepiece holder
- LX90 OTA has Meade Flip-Mirror for ease in finding guide stars

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MDAS

P.O. Box 4889

Walnut Creek, CA 94596-

General Meetings:

Fourth Tuesday every month,

except on the third Tuesday

Refreshments and conversations

Meetings begin at 7:15pm.

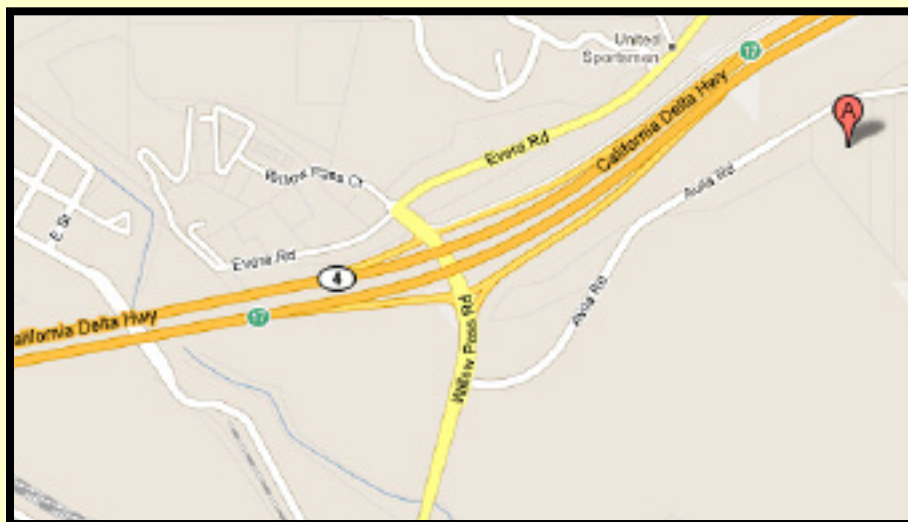
Where:

Concord Police Association

5060 Avila Road, top of the

Take Avila Road from Willow

Directions to facility:



Your Help Would Be Greatly Appreciated

Our association needs a few members to come at 6:30 p.m. before our monthly meeting which starts at 7:15 p.m. to help in setting up the chairs and other elements needed to conduct the general meeting.

Similarly at the end of each meeting the chairs and tables have to be removed, the room has to be cleaned and the garbage emptied.

Thank you for your help.

